EPA/ROD/R04-94/206
1994

EPA Superfund
Record of Decision:

ROBINS AIR FORCE BASE (LANDFILL #4/SLUDGE LAGOON)
EPA ID: GA1570024330
OU 02
HOUSTON COUNTY, GA
03/29/1994

Text:

DECLARATION FOR THE INTERIM ACTION
RECORD OF DECISION

SITE NAME AND ADDRESS

Zone 1 Robins Air Force Base
Operable Unit 2, Impact on Wetlands
Warner Robins, Houston County, Georgia

STATEMENT OF PURPOSE

This Decision Document presents the interim selected remedial action for O the Zone 1 Robins Air Force Base (AFB) Site, Houston County, Georgia chose accordance with the Comprehensive Environmental Response, Compensation, an Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Ac and to the extent practicable, the National Oil and Hazardous Substances P Contingency Plan (NCP). This decision is based on the Administrative Reco which is on the file in the Directorate of Environmental Management office Georgia 31098.

This interim remedial action is taken to protect human health and the envi threat, while final remedial solutions are being developed. The State of IV, USEPA concur with the selected interim remedy.

ASSESSMENT OF THE SITE

The wetlands associated with Zone 1, OU2 provide an important habitat for wetlands plant and animal species, and protection of the wetlands should b

high priority. Actual or threatened releases of hazardous substances from addressed by implementing the response action selected in this Interim Act Decision (ROD), may present an imminent and substantial endangerment to pu welfare or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The Zone 1 Robins AFB site is divided into three operable units. Operable

addresses Landfill No. 4 and the Sludge Lagoon and comprises source contro

Unit 2 (OU2) is a phase to determine the degree of impact that has occurre

downgradient wetlands area (east and southeast of Landfill No. 4). Operab

addresses the groundwater beneath and adjacent to Landfill No. 4 and the S

The scope of this ROD is limited to OU2.

The selected interim remedy for OU2, limited action, includes the followin

Institutional controls (i.e., fence construction to restrict for future site access and water use restrictions

Comprehensive monitoring for a minimum of one year not to exc years in support of physical/chemical and ecological/biologic plans to be developed to monitor stabilization of the site fo of runoff discharge around the landfill and diversion of indu discharge from upgradient of the landfill and wetlands, so th action can be developed from the current and expected future

Development of a contingency plan that describes containment implemented in the event that predetermined "trigger values"

Both the physical and chemical characteristics of the wetlands may have be the collection of data used to determine the need for remediation. The po caused by two events. One event was the redirection of runoff from a 400- from through the landfill to around the landfill.

The second event was the completion of a pipeline that now routes approxim gallons a day of domestic and industrial wastewater directly to the Ocmulg discharge used to be into and through the wetlands to the Ocmulgee River. the monitoring program is to evaluate the expected changes so that the fin developed to address the current/future conditions.

STATUTORY DETERMINATION

This interim action is protective of human health and the environment, wai State Applicable or Relevant and Appropriate Requirements for this limited is cost-effective. This action is interim and is not intended to provide and alternative treatment or recovery technologies, to the maximum extent OU2. Because the action will not constitute the final remedy for OU2, the preference for remedies that employ treatment that reduces toxicity, mobil principal element will be addressed by the final response action. Subsequ

planned to address fully the threats posed by the conditions at OU2. Beca will result in hazardous substances remaining on site above health-based l be conducted to ensure that the remedy continues to provide adequate prote health and the environment within five years after commencement of the rem Because this is an interim action ROD, review of this site and this remedy the Air Force continues to develop remedial altematives for OU2.

_____ _____

ALAN P. BABBIT Date
Acting Deputy Assistant Secretary of the Air Force
(Environmental, Safety and Occupational Health)

_____ _____

Assistant Administrator/Regional Administrator
U.S. Environmental Protection Agency, Region 4

DECISION SUMMARY

1.0 SITE NAME, LOCATION AND DESCRIPTION

Robins AFB is an active facility occupying 8,855 acres about 18 miles sout Georgia (Figure 1). Robins AFB is bounded on the immediate west by the Ci Robins, on the north by a housing subdivision in Houston County, on the so unincorporated Bonaire, and on the east by the Ocmulgee River and its floo

The Zone 1, Robins AFB, National Priority List (NPL) site is located in th of the base. Zone 1 consists of Landfill No. 4, which covers 45 acres, an acre sludge lagoon (Figure 2). The study area associated with OU2 is loca southeast of Landfill No. 4 (Figure 2).

Zone 1 is located adjacent to a bluff that forms the western boundary of t floodplain. The floodplain extends about 1 to 2 miles eastward to the riv was originally constructed by disposing of fill material into the floodpla from the bluff and advancing to the east. The sludge lagoon was construct boundary of Landfill No. 4 by excavating and building earthen dikes. Surf Robins AFB generally drains from west to east into the Ocmulgee River floo

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2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Robins AFB currently serves as a worldwide logistics management center for missiles and support systems, and is a major repair center for aircraft an systems.

Robins AFB has generated various types of solid wastes over the years, inc hazardous wastes. The hazardous wastes include electroplating wastes cont metals and cyanide, organic solvents from cleaning operations and fire tra off-specification chemicals such as pesticides.

In 1982, Robins AFB conducted a base-wide survey to identify and assess pa waste disposal practices. Disposal areas were grouped into eight zones ba location and type of disposal activity. Zone 1 (Landfill No. 4 and the Sl considered to have the highest potential for migration of hazardous substa was placed on the CERCLA NPL by the U.S. Environmental Protection Agency (1987. Landfill No. 4 reportedly operated from 1965 until 1978 for disposa and industrial wastes. The Sludge Lagoon was used for disposal of industr

treatment plant sludges and other liquid wastes from 1962 to 1978. The La Sludge Lagoon were both closed and covered with clean fill in 1978.

In June of 1989, Robins AFB entered into a Federal Facilities Agreement wi Department of Environmental Protection (GEPD) and the EPA to establish a p framework and schedule for developing, implementing, and monitoring approp actions at thc site in accordance with CERCLA, the NCP, Superfund guidance and the Georgia Hazardous Waste Management Act (GHWMA).

The initial remedial investigation/feasibility study (RI/FS) for Zone 1 wa The initial RI focused primarily on the sludge lagoon and Landfill No. 4, organic and inorganic contamination in groundwater, surface water, sedimen

initial FS focused primarily on Zone 1 under OU1. The remedial action goa protection of human health and described in the FS study and ROD under OU1 source control.

A supplemental RI was performed and completed in 1992 to further assess th risks associated with the site as it relates to the study area associated

The following reports describe the results of investigations at Zone 1, OU

HAZWRAP, U.S. Air Force Installation Restoration Program, Supplemen Remedial Investigation, Zone 1, Operable Unit 2. Robins AFB, Novemb

HAZWRAP, U.S. Air Force Installation Restoration Program, Feasibili Zone 1, Operable Unit 2. Robins AFB, July 1993.

3.0 HIGHLIGHTS OF CONIMUNITY PARTICIPATION

The RI for the Robins AFB Zone 1 OU2 impact on wetlands was released to th November 1992, and the FS in July 1993. The Proposed Plan was released on 1993 for public comment. These documents were made available to the publi

Administrative Record located at the Directorate of Environmental Manageme and at the Environmental Information Repository at the Nola Brantley Memor Warner Robins. The notice of availability of these documents was publishe Telegraph and the Daily Sun. A public comment period was held from August through September 29, 1993. A public meeting for OU2 was held on Septembe At this meeting, representatives of Robins AFB, EPA, and the GEPD answered about the site and the remedial alternatives under consideration. A trans meeting can be reviewed at the information repository.

The Proposed Plan identified the preferred interim remedy for the area ass Alternative 2, from the FS (see Section 4); use of institutional controls and water use restrictions, and a Comprehensive Monitoring Program that wi determine the stability of the site. Robins AFB, EPA, and GEPD reviewed a verbal comments submitted during the public comment period. Upon review o comments, it was determined that significant changes to the Proposed Plan remedy were not necessary.

4.0 SCOPE AND ROLE OF OPERABLE UNIT 2

The overall strategy of Zone 1 is divided into three operable units. The action selected in this ROD is applicable to OU2.

OU2 is directed at determining the degree of impact that may have occurred area and surface waters from the known source of contamination in OU1 and the impacts identified. OU1 addresses Landfill No. 4 and the Sludge Lagoo source control. OU3 is directed at determining the degree of impact that in the groundwater beneath and adjacent to Landfill No. 4 and the Sludge L remediation of impacts identified.

The overall goals of the selected interim remedy for the area associated w

Protect existing habitat

Minimize the potential direct exposure of the public and base person substances

Monitor water balance stabilization of the site following redirectio discharge and diversion of industrial wastewater discharge.

These goals would be achieved by the use of institutional controls for fut water use restrictions. In addition, the comprehensive monitoring program evaluate changes to the site caused by the completion of a runoff diversio redirects runoff from a 400-acre watershed from through the landfill to ar and the completion of a pipeline that routes 2 million gallons a day of in the Ocmulgee River that had formerly been discharged through the wetlands. information can be used to develop a final action for the site which addre future conditions.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 SUMMARY OF ZONE 1 HYDROLOGY

The local topography, soils, and climate determine how water moves through 1 of the Robins AFB is located on the western edge of the floodplain of th (Figure 2). The floodplain in Zone 1 is a low flat region covered by wetl water. The surface and groundwater flow across Zone 1 is generally to the Horse Creek, a south-flowing tributary of the Ocmulgee River, and to the O

The Zone 1 wetland soils consist of approximately 6 ft of saturated organi

underlain by a layer of clay ranging in thickness up to approximately 10 f underlain by an interbedded sand and gravel deposit that constitute the al under most of Zone 1. The clay layer is thought to restrict water flow be and the alluvial aquifer, and to cause the alluvial aquifer to exist under conditions. Landfill No. 4 and sludge lagoon were placed on the western e floodplain wetland deposits. Fill materials associated with the landfill and comprise the surficial fill aquifer unit.

The western edge of the Ocmulgee River floodplain is defined by a relative ft. increase in elevation along the southern, western, and northern bounda upland areas adjacent to the Ocmulgee River floodplain consist of sand, gr layers of the Providence Formation. Portions of these upland areas adjace within the topographic basin that drains into the Zone 1 wetlands. The Zo therefore, the hydrologic sink or receptor area for the topographically hi drainage basin.

The Robins AFB is located in a humid, temperate region characterized by hi Average annual precipitation at the base is 44.9 in., with an estimated ev of approximately 38.4 in. per year. The difference between precipitation

spiration, approximately 6.5 in. per year, results in a large quantity of recharge to the groundwater and surface water systems. Urbanization and d associated with base activities in the uplands portion of the Zone 1 drain resulted in a predominance of paved areas. The decrease in vegetation in areas reduces evapotranspiration losses while the impervious surfaces prev recharge of the groundwater system. The result is that in the developed p 1 drainage basin, most of the precipitation that falls will flow via surfa and through the Zone 1 wetlands.

Most of the surface water runoff that leaves the upland areas of the Zone concentrated into several storm sewers, which discharge at numerous locati eastern edge. The remainder of the surface water entering Zone 1 flows di Creek from north of Zone 1, east of the Base runways.

Hannah Road and Lights Service Road traverse portions of Zone 1 (Figure 2) surface water flow in the area. The roads are built on embankments of imp restrict the flow of surface water across Zone 1. Surface water located i portion of Zone 1 west of Hannah Road leaves the area primarily through tw under Hannah Road. Surface water present in the wetlands west of the over structures tend to flow toward the structures. Rates of flow near the ent structures would therefore be expected to be higher than would surface wat further away from these control structures.

Groundwater is present in Zone 1 in several aquifer units. Although flow aquifers is low compared to surface water flow, the aquifer units exhibit contaminant concentrations and may therefore contain a majority of the con that is present in Zone 1. The important aquifers include the surficial f and the Providence Formation. Beneath the Providence Formation aquifer is Clay Formation and Blufftown Aquifer.

The surficial fill aquifer exists in Landfill No. 4, the sludge lagoon, an associated with the Hannah and Lights Service road embankments, where arti been placed into the wetlands peat and clay deposits. A schematic cross-s Zone 1 showing assumed groundwater flow directions and interactions is sho

The alluvial gravel aquifer is present under the peat and clay deposits th

floodplain area in Zone 1 except for the west portion of the landfill. Gr consistently to the east. Water levels in wells penetrating this aquifer the aquifer surface, indicating that the aquifer is under semi-confined co alluvial gravel deposits, like the clay and peat layers above it, decrease the west and disappear along the westem edge of the Ocmulgee River floodpl Cross sections compiled from existing borehole data suggest that the peat, gravel deposits all disappear somewhere beneath the western portion of Lan

Beneath the alluvial gravel aquifer is the Providence Formation. This geo across the entire site and comprises the upland surface immediately west o groundwater flow in this aquifer is also toward the east. Based on limite component of flow between the alluvial gravel and Providence Formation aqu Zone 1 appears to be generally upward toward the alluvial gravel aquifer t The landfill solids and surficial fill aquifer may be in direct hydraulic the Providence aquifer in the westem portion of the landfill, where the in clay, and alluvial gravel deposits are thin or absent. The alluvial aquif of the landfill where vertical gradients in the providence are downward.

5.2 AQUATIC BIOLOGY

Macroinvertebrate sampling conducted during the Zone 1, OU2 RI field inves demonstrated that stations located downgradient generally exhibit greater and larger populations than upgradient stations. The results of a Rapid B

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Protocol III analysis conducted for the OU2 RI showed some locations in bo downgradient areas demonstrate nonimpairment while others are severely imp

5.3 WETLAND ECOLOGY

Vegetation surveys conducted during the Zone 1, OU2 RI field investigation numerous vegetative zones and habitats and a diverse flora associated with emergent wetlands, and mature bottomland hardwood forest. Potentially occ threatened and endangered species in the OU2 study area include dwarf witc catchers, hooded pitcher-plant, sweet pitcher-plant, and Florida willow.

5.4 WILDLIFE BIOLOGY

A breeding bird survey conducted during the Zone 1, OU2 RI field investiga significant differences or trends in the types of species observed in the areas. The survey showed that there are numerous species present that are healthy bottomland forest ecosystems. Results are summarized on Table 1. occurring threatened and endangered species in the OU2 study area include alligator, Bald eagle, Florida panther, and Wood stork.

5.5 EVALUATION OF CONTAMINANT SOURCES

The OU2 field investigations were designed to collect information necessar relationship between compounds detected in the wetlands and compounds pres Landfill No. 4 and sludge lagoon. The site conceptual flow model indicate flow through Zone 1 is surface water, and that a majority of the surface w Zone 1 originates from sources hydrologically upgradient of the Zone 1 stu

TABLE 1
SUMMARY OF BREEDING BIRD SPECIES OBSERVED
RI/FS ZONE 1, OU2
Robins AFB, Georgia

Cattle Egret	Bubulcus ibis

Great Egret	Casmerodius albus
Great Blue Heron	Ardea herodias
Mallard	Anas platyrhynchos
Killdeer	Charadrius vociferus
Lesser Yellowlegs	Tringa flavipes
Solitary Sandpiper	Tringa solitaria
Sanderling	Calidris alba
Turkey Vulture	Cathartes aura
Northern Bobwhite	Circus virginianus
Rock Dove	Columba livia
Mourning Dove	Zenaida macroura
Yellow-billed Cuckoo	Coccyzus americanus
Barred Owl	Strix varia
Common Nighthawk	Chordeiles minor
Chimney Swift	Cohaetura pelagica
Ruby Throated Hummingbird	Archilochus alexandri
Belted Kingfisher	Ceryle alcyon
Red-bellied Woodpecker	Melanerpes carolinus
Common Flicker	Colaptes auratus
Downy Woodpecker	Picoides pubescens
Hairy Woodpecker	Picoides villosus
Pileated Woodpecker	Dryocopus pileatus
Eastern Kingbird	Tyrannus ryrannus
Great-crested Flycatcher	Myiarchus crinitus

TABLE 1 (Cont.)

SUMMARY OF BREEDING BIRD SPECIES OBSERVED
RI/FS ZONE 1, OU2
Robins AFB, Georgia

Eastern Wood Peewee	Contous virens
Eastern Phoebe	Sayornis phoebe
Acadian Flycatcher	Empidonax virescens
Tree Swallow	Tachycineta bicolor
Northern Rough-winged Swallow	Steigidopteryx serripenn
Barn Swallow	Hirundo rustica
Blue Jay	Cyanocitta cristata
American (Common) Crow	Corvus brachyrhynchos
Fish Crow	Corvus ossifragus
Tufted Titmouse	Parus bicolor
Carolina Chickadee	Parus carolinensis
White-breasted Nuthatch	Sitta carolinensis
Carolina Wren	Thryothorus ludovicianus
Blue-gray Gnatcatcher	Polioptila caerulea
Eastern Bluebird	Sialia sialis
Wood Thrush	Hylocichia mustelina
American Robin	Turdus migratorius
Loggerhead Shrike	Lanius ludovicianus
Gray Catbird	Dumetella carolinensis
Northern Mockingbird	Mimus polyglottos
Brown Thrasher	Toxostoma rufum
European Starling	Sturnus vulgaris
White-eyed Vireo	Vireo griseus
Yellow-throated Vireo	Vireo flavifrons
Red-eyed Vireo	Vireo olivaceus

TABLE 1 (Cont.)
SUMMARY OF BREEDING BIRD SPECIES OBSERVED
RI/FS ZONE 1, OU2
Robins AFB, Georgia

Prothonotary Warbler	Prothontaria citrea
Northern Parula	Parula americana
Black and White Warbler	Mniotilta varia
Cerulean Warbler	Dendroica cerulea
Magnolia Warbler	Dendroica magnolia
Yellow-rumped Warbler	Dendroica coronata
Yellow-throated Warbler	Dendroica dominica
Prairie Warbler	Dendroica discolor
Pine Warbler	Dendroica palmarum
Yellow Warbler	Pendroica petechia
Kentucky Warbler	Oporornis formosus
Hooded Warbler	Wilsonia citrina
Worm-eating Warbler	Helmitheros vermivorus
Swainson's Warbler	Limnothlypis swainsonii
Ovenbird	Seiurus aurocapillus
Louisiana Waterthrush	Seiurus motacilla
Common Yellowthroat	Geothlypis trichas
Yellow-breasted Chat	Octeroa virens
Northern Cardinal	Cardinalis cardinalis
Indigo Bunting	Passerina cyanea
Rufous-sided Towhee	Pipilo erythrophthalmus
Easten Meadowlark	Sturnella magna

Red-winged Blackbird	Agelaius phoeniceus
Brown-headed Cowbird	Molothrus ater
Common Grackle	Quiscalus quiscula

TABLE 1 (Cont.)
SUMMARY OF BREEDING BIRD SPECIES OBSERVED
RI/FS ZONE 1, OU2
Robins AFB, Georgia

Scarlet Tanager	Piranga olivacea
Summer Tanager	Piranga rubra
Double-crested Cormorant	Phalacrocorax auritus
Anhinga	Anhinga anhinga
Wood duck	Aix sponsa
Red-tailed Hawk	Buteo jamaicensis
Green Heron	Butorides striatus
Yellow-bellied Sapsucker	Sphyrapicus varius
Song Sparrow	Melospiza melodia
White Ibis	Eudocimus albus
Little Blue Heron	Egretta Caerulea
American Red start	Setophaga ruticilla
Rose-breasted Grosbeak	Pheucticus ludovicianus
Northern Harrier	Circus cyaneus
Red-shouldered Hawk	Buteo lineatus
Broad-winged Hawk	Buteo platypterus

boundaries. The following surface water, aquatic sediment, or wetland soi were determined to be located hydraulically upgradient of the landfill and

not effected by Zone 1 contaminants.

CDM Sample Sites:	S1, S2, S3, S9, S10, S14, SR
CH2M HILL Sites:	BCG-SED-01, -02, -03
	BCG-SW-O1, -02, -03, LF27

At most sample sites, more than one type of sample (e.g., surface water, s soil, biota samples) were collected. Refer to Figures 4 and 5 for sample Figure 6 illustrates the CH2M Hill background samples. The site conceptua suggests that the surficial fill aquifer, located beneath the landfill and discharges water laterally into the wetlands surface water or peat deposit of the landfill, and also vertically into the underlying alluvial gravel a Formation aquifers along the western margins of the floodplain. Groundwat gravel and Providence Formation aquifers is likely to be isolated from the east of the landfill due to the presence of an extensive clay layer.

Summaries of detected compounds for all samples were used to evaluate pote areas. Listings of both the number of detections and the maximum detected were compiled separately for upgradient and downgradient sample population groundwater, surface water, and sediment results. Wetland soil sample res with sediment results for this evaluation. The individual lists were then tables based on media type. Table 2 lists the summary results for all liq including landfill and sludge lagoon leachate, groundwater, and surface wa the summary results for all solids media samples, including sludge lagoon samples, landfill surface soil (listed as Landfill soils), and sediment/so detected in any of the listed sample media were included on both Tables 2 the evaluation of potential source areas.

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TABLE 2

DETECTIONS OF ANALYTES IN LIQUID MEDIA

COMPOUNDS DETECTED IN SURFACE WATER AT LEAST ONE MEDIUM ORGANIC COMPOUND (in ug/l)	SOURCE AREA SLUDGE LAGOON FREQ.	MAX CONC	LEACHATE* LANDFILL FREQ.	MAX CONC	UPGRADIENT FREQ.	MAX CONC	GROUNDW UPGRADIENT CONC	DOWNGRADIENT FREQ.	MAX CONC
1,1-DICHLOROETHANE	6/9	300	2/15	11			6		
1,1-DICHLOROETHENE	2/9	100	1/15	1.2			3		
1,1,1-TRICHLOROETHANE	1/9	130	5/15	33	1/7	2			
1,1,2-TRICHLOROETHANE	1/9	59							
1,1,2,2-TETRACHLOROETHANE									
1,2-DICHLOROBENZENE	2/5	28000							
1,2-DICHLOROETHANE	1/9	620					4		
1,2-DICHLOROETHENE (1,2-DCE)	6/9	36000	3/15	31					
1,2-DICHLOROETHENE (TOTAL)							27		21.00
1,2-DICHLOROPROPANE							1		
1,2,4-TRICHLOROBENZENE									
1,3-DICHLOROBENZENE	2/5	950							
1,3-DICHLOROPROPENE (CIS)							l		
1,4-DICHLOROBENZENE	2/5	13000	3/5	120					
1,4-PENTADIENS, 2,3,4-TRIMET									
11H-CYCLOPENTA(A)PHENANTHREN									
1H-INDENE, OCTAHYDRO-2,3A,4-									
2-BUTANONE	4/9	890	3/15	120			1		
2-FURANMETHANOL, 5-ETHENYLTE									
2-HEXANONE			1/15	8.2			2		
2-METHYLNAPHTHALENE									
2,4-DIMETHYLPHENOL	3/8	11000							
3,4-BENZOFLUOPANTHENE									
3-HEXENE-2,5-DIONE									
4,4'-DDD	4/5	12	3/3	7					
4,4'-DDE	2/5	0.26	3/3	5					
4,4'-DDT	4/5	8	2/3	0.1					
4-CLORO-3-METHYLPHENOL									
4-METHYL-2-PENTANONE	2/9	650	1/15	6.6	1/7	56	5		

ACENAPHTHENE					1/5	15						
ACENAPHTHYLENE												

TABLE 2 (Cont.)

DETECTIONS OF ANALYTES IN LIQ

COMPOUNDS DETECTED IN SURFACE WATER AT LEAST ONE MEDIUM	SOURCE AREA LEACHATE*						GROUNDWATER			
ORGANIC	SLUDGE LAGOO		LANDFILL		UPGRADIENT		D UPGRADIENT		DOWNGRADIENT	
COMPOUND (in ug/l)	FREQ.	MAX CONC	FREQ.	MAX CONC	FREQ.	MAX CONC	FR	CONC	FREQ.	MAX CONC
CETONE	7/9	4300	9/14	61				49		
LDRIN										
NTHRACENE										
ZULENE,1,4-DIMETHYL-7-(1-M										
ENZENE	7/9	660	11/15	85	2/7	13		8		
ENZO(A)ANTHRACENE										
ENZO(A)PYRENE										
ENZO(G,H,I)PERYLENE										
ENZO(B)FLUORANTHENE										
ENZO(K)FLUORANTHENE										
ENZOIC ACID										
ENZYL ALCOHOL										
CYCLO[2.2.1]HEPTAN-2-OL, 1										
CYCLO[2.2.1]HEPTAN-2-ONE										
S(2-CHLOROISOPROPYL)ETHER										
S(1,1 -DIMETHYLETHYL)PHENOL										
S(2-ETHYLHEXYL)PHTHALATE	1/5	14	2/5	660				1	120.00	
ORNEOI (8CI)										
ROMODICHLOROMETHANE	1/9	1								
UTYLBENZYLPHTHALATE										
AMPHENE (DOT) (8CI)										
ARBON DISULFIDE								4		
CARBON TETRACHLORIDE					3/7	110		22		
ARYOPHYLLENE (VAN)										
CHLORDANE, TECHNICAL	2/5	0.100	1/3	37.0						
CHLORDANE, ALPHA										
CHLORDANE, GAMMA										
CHLOROBENZENE	6/9	4000	9/15	150				1		
CHLOROETHANE			1/15	81						
CHLOROFORM	2/9	28	3/15	3	2/7	3		2		
CHLOROMETHANE										
CHRYSENE										

TABLE 2 (Cont.)

DETECTIONS OF ANALYTES IN LIQUID MEDIA

COMPOUNDS DETECTED IN SURFACE WATER EAST ONE MEDIUM ANIC	SOURCE AREA LEACHATE* SLUDGE LAGOO		LANDFILL		GROUND UPGRADIENT		UPGFIADIENT	DOWNGRADIENT
POUND (in ug/l)	FREQ.	MAX CONC	FREQ.	MAX CONC	FREQ.	MAX CONC	F CONC	FREQ. MAX CONC FREQ. MAX CONC
OLE (VAN)								
SOL-O	3/7	2200						
SOL-M,P	3/7	7900	4/14	170				
OHEXANE ISOMER								
OHEXANOL,2-BROMO-TRANS-(								
NZO(a,h) ANTHRIACENE								
TYL PHTHALATE	1/5	550						
BUTYLPHTHALATE								
OCTYLPHTHALATE								
NZOFURAN								
OMOCHLOROMETHANE								
LORO-CYCLOHEXANE ISOMER								
ORIN	2/5	0.02			1/7	0.18		
HYL PHTHALATE								
IMETHYL-4-NAPHTHALENE								
THYL PHTHALALTE								
LBENZENE	5/9	410	7/15	6.3	2/11	6		
RANTHENE			1/5	21				
RENE			1/5	17				
ACHLOR								
NO(1,2,3-CD)PYRENE								
METHANE								
ORNEOL(8CI)								
ANE, TOTAL (g-BHC)								
YLENE CHLORIDE	6/9	6000	9/15	110			73 12.00	
ROSODIPHENYLAMINE								
THALENE	2/5	560	4/5	30				
THALENE, 1,2,3,4,4A,5,6								
THALENE, 1,2,3,4-TETRAHY								
THALENE, 1,2,4A,5,6,8A-H								
DECANAL ISOMER								
1254	2/5	0.7	1/3	100				

DETECTIONS OF ANALYTES IN LI

COMPOUNDS DETECTED IN SURFACE WATER AT LEAST ONE MEDIUM	SOURCE AREA LEACHATE*				GROUNDWATE			
ORGANIC COMPOUND (in ug/l)	SLUDGE LAGOO FREQ.	MAX CONC	LANDFILL FREQ.	MAX CONC	UPGRADIENT FREQ.	MAX CONC	DOWNGRADIENT FREQ.	MAX CONC
PCB-1260								
PENTACHLOROPHENOL	2/8	2.6	2/15	36				
PHENANTHRENE			1/5	37				
PHENOL	4/8	3600	8/15	49	1/1	1		
PHENOL,2,6-DIMETHOXY-4-(2-								
PYRENE			1/5	14				
STIGMAST-4-EN-3-ONE								
STYRENE								
TETRACHLOROETHYLENE	4/9	1100	1/15	3.2	1/7	29		
TOLUENE	6/9	2200	9/15	33	2/11	34		
TRICHLOROETHYLENE	6/9	130000	4/15	8.1	7/7	880	23/38	52.00
TRICHLOROFLUOROMETHANE	1/8	5100						
VINYL CHLORIDE	5/9	12000	3/15	12				
XYLENES (TOTAL)	6/9	2200	9/15	26	3/7	49		

TABLE 2 (Cont.)

DETECTIONS OF ANALYTES IN LIQUID

	SOURCE AREA LEACHATE*				GROUNDWATER*			WATER
TALS (in ug/l)	SLUDGE LAGOO FREQ.	MAX CONC	LANDFILL FREQ.	MAX CONC	UPGRADIENT FREQ.	MAX CONC	DOWNGRADIENT FREQ.	MAX CONC
UMINUM					9/11	7100	46/46	
TIMONY							1/46	
SENIC	6/6	21000	14/14	13000	1/11	8	18/101	
RIUM	6/6	1600	14/14	4200	7/8	98	104/104	
RYLLIUM	4/6	80	8/14	22			9/104	
RON								
DMIUM	6/6	34800	14/14	9300	1/11	7.3	8/101	
LCIUM					9/9	18800	48/48	
ROMIUM	6/6	13163000	14/14	66000	2/11	63	39/101	272.94
BALT							4/46	
PPER	6/6	10600	13/14	3600			45/101	

ANIDE	4/6	320	7/14	574			9/101
ON					8/9	5400	46/46
AD	5/6	60000	14/14	10400	6/11	28	67/101
GNESIUM					7/9	1310	46/46
NGANESE					10/11	40.7	36/46
RCURY	6/6	85	14/14	880	5/11	0.9	20/101
CKEL	6/6	15000	14/14	1300	2/11	17.8	28/101
TASSIUM					7/9	1970	43/46
LENIUM	2/6	40	9/14	23	1/11	30	5/101
VER	4/6	80	12/14	40			3/101
DIUM					4/9	5950	40/46
LFIDE			10/11	7000			11/46
LFUR, MOL. (S8)							
ALLIUM	1/6	5	3/14	6			3/101
NADIUM					3/9	2320	13/46
C	6/6	64400	14/14	60000	8/11	55.2	96/101

NOTES:
= Not Analyzed.
Blank spaces indicate compound was analyzed for but not detected.
Data from CH2M HILL, 1990.

TABLE 3

DETECTIONS OF ANALYTES IN SOLIDS ME

COMPOUNDS DETECTED IN AT LEAST ONE MEDIUM	SOURCE AREA*							
ORGANIC	SLUDGE LAGOON		LANDFILL		LANDFILL SOI DOWNGRADIENT			
COMPOUND (ug/kg)	FREQ.	MAX CONC	FREQ.	MAX CONC	FREQ.	MAX C	MAX CONC	FREQ. MAX CONC
1,1-DICHLOROETHANE	3/23	260						
1,1-DICHLOROETHENE	1/23	3						
1,1,1-TRICHLOROETHANE								
1,1,2-TRICHLOROETHANE	2/23	400						
1,1,2,2-TETRACHLOROETHANE			1/14	1.40				
1,2-DICHLOROBENZENE	3/11	1700000	1/5	110				
1,2-DICHLOROETHANE	1/23	70						
1,2-DICHLOROETHENE (1,2-DCE)	9/23	100000						
1,2-DICHLOROETHENE (TOTAL)								
1,2-DICHLOROPROPANE								
1,2,4-TRICHLOROBENZENE	1/11	52000						
1,3-DICHLOROBENZENE	3/11	58000						
1,3-DICHLOROPROPENE (CIS)								
1,4-DICHLOROBENZENE	4/11	690000	2/5	600	1/13	9		
1,4-PENTADIENS, 2,3,4-TRIMET								
11H-CYCLOPENTA[A]PHENANTHREN								
1H-INDENE, OCTAHYDRO-2,3A,4-								

2-BUTANONE	6/23	3100	3/14	1100	
2-FURANMETHANOL, 5-ETHENYLTE					
2-HEXANONE			2/14	1400	
2-METHYLNAPHTHALENE					
2,4-DIMETHYLPHENOL	2/23	120000			
3,4-BENZOFLUORANTHENE					
3-HEXENE-2,5-DIONE					
4,4'-DDD	3/4	930	1/2	2	
4,4'-DDE	3/4	200	1/2	2	
4,4'-DDT	3/4	240	1/2	1	1/13
4-CHLORO-3-METHYLPHENOL	1/23	460			
4-METHYL-2-PENTANONE			1/14	21	
ACENAPHTHENE	1/11	200	2/15	3800	
ACENAPHTHYLENE					

TABLE 3 (Cont.)

DETECTIONS OF ANALYTES IN SOLIDS MED

COMPOUNDS DETECTED IN AT LEAST ONE MEDIUM	SOURCE AREA*							
ORGANIC COMPOUND (ug/kg)	SLUDGE LAGOON FREQ.	MAX CONC	LANDFILL FREQ.	MAX CONC	LANDFILL FREQ.	MAX C	LANDFILL SO DOWNGRADIENT MAX CONC	FREQ. MAX CONC
ACETONE	4/8	630	5/7	2100	2/13	3		
ALDRIN	1/4	2.6						
ANTHRACENE	2/11	600	1/5	6400				
AZULENE, 1,4-DIMETHYL-7-(1-M								
BENZENE	5/23	2800	2/14	1.7				
BENZO(A)ANTHRACENE	2/11	2700	2/5	300				
BENZO(A)PYRENE	2/11	2200	3/5	400				
BENZO(G,H,I)PERYLENE	2/11	1300	1/5	200				
BENZO(B)FLUORANTHENE	2/11	2700	3/5	400	1/13	1	790.00	
BENZO(K)FLUORANTHENE	2/11	1600	1/5	300			2000.00	
BENZOIC ACID					1/13	2		
BENZYL ALCOHOL								
BICYCLO[2.2.1]HEPTAN-2-OL,1								
BICYCLO[2.2.1]HEPTAN-2-ONE								
BIS(2-CHLOROISOPROPYL)ETHER								
BIS(1,1-DIMETHYLETHYL)PHENOL								
BIS(2-ETHYLHEXYL)PHTHALATE	3/11	76000	3/5	4300	5/13	5	17/64	16000.00
BORNEOL (8CI)								
BROMODICHLOROMETHANE								
BUTYLBENZYLPHTHALATE	2/11	7100	1/5	600	12/13	2	72.00	
CAMPHENE (DOT) (8CI)								

CARBON DISULFIDE	1/23	3	1/14	2		
CARBON TETRACHLORIDE						
CARYOPHYLLENE (VAN)						
CHLORDANE (TECHNICAL)	3/4	8500	2/2	940		
CHLORDANE, ALPHA					1/13	
CHLORDANE, GAMMA					1/13	
CHLOROBENZENE	8/23	20000	2/14	11	2/13	220.00
CHLOROETHANE						
CHLOROFORM	6/23	17000	1/14	2		
CHLOROMETHANE						

TABLE 3 (Cont.)

DETECTIONS OF ANALYTES IN SOLIDS ME

COMPOUNDS DETECTED IN AT LEAST ONE MEDIUM	SOURCE AREA*							
ORGANIC	SLUDGE LAGOON		LANDFILL		LANDFILL SOI		DOWNGRADIENT	
COMPOUND (ug/kg)	FREQ.	MAX CONC	FREQ.	MAX CONC	FREQ.	MAX C	MAX CONC	FREQ. MAX CONC
CHRYSENE	2/11	3100	3/5	300				
CINEOLE (VAN)								
CRESOL-O	2/21	13000						
CRESOL-M,P	2/21	50000	4/13	1800	1/13			
CYCLOHEXANE ISOMER								
CYCLOHEXANOL,2-BROMO-TRANS-(								
DIBENZO(a,h) ANTHRACENE	2/11	400						
DIBUTYL PHTHALATE	2/11	35000	2/5	3100	13/13	6		
DI-N-BUTYLPHTHALATE								
DI-N-OCTYLPHTHALATE								
DIBENZOFURAN								
DIBROMOCHLOROMETHANE								
DICHLORO-CYCLOHEXANE ISOMER								
DIELDRIN	2/4	200	1/2	1				
DIETHYL PHTHALATE	1/11	600	1/5	170	13/13	1		
1,6-DIMETHYL4-NAPHTHALENE								
DIMETHYL PHTHALALTE								
ETHYLBENZENE	8/23	5600	4/14	14	2/13			
FLUORANTHENE	5/11	4800	3/5	1500				
FLUORENE	1/11	200	1/5	3100				
HEPTACHLOR	1/4	2						
INDENO(1,2,3-CD)PYRENE	2/11	1400	1/5	200				
IODOMETHANE								
ISOBORNEOL (8CI)								
UNDANE, TOTAL (g-BHC)								
METHYLENE CHLORIDE	6/7	950	2/2	130	13/13	1	250.00	
N-NITROSODIPHENYLAMINE								

NAPHTHALENE	6/11	80000	3/5	2100
NAPHTHALENE, 1,2,3,4,4A,5,6				
NAPHTHALENE, 1,2,3,4-TETRAHY				
NAPHTHALENE,1,2,4A,5,6,8A-H				

TABLE 3 (Cont.)

DETECTIONS OF ANALYTES IN SOLIDS MEDIA

COMPOUNDS DETECTED IN AT LEAST ONE MEDIUM	SOURCE AREA*							
	SLUDGE LAGOON		LANDFILL		LANDFILL SOILS DOWNGRADIENT			
ORGANIC COMPOUND (ug/kg)	FREQ.	MAX CONC	FREQ.	MAX CONC	FREQ.	MAX CONC	FREQ.	MAX CONC
OCTADECANAL ISOMER								
PCB-1254	2/4	2500	1/2	500				
PCB-1260	1/4	36.0						
PENTACHLOROPHENOL								
PHENANTHRENE	3/11	2900	4/5	5800				
PHENOL	2/23	18000	3/14	200				
PHENOL,2,6-DIMETHOXY-4-(2-								
PYRENE	3/11	3600	3/5	1000				
STIGMAST-4-EN-3-ONE								
STYRENE								
TETRACHLOROETHYLENE	5/23	59000						
TOLUENE	13/23	20000	5/14	43	13/13	250		
TRICHLOROETHYLENE	3/23	2500000						
TRICHLOROFLUOROMETHANE	1/21	68000						
VINYL CHLORIDE	1/23	110						
XYLENES (TOTAL)	8/23	38000	7/14	110	1/13	4		

TABLE 3 (Cont.)

SOURCE AREA*

	SLUDGE LAGOON		LANDFILL		LANDFILL SOILS DOWNGRADIENT			
METALS (mg/kg)	FREQ.	MAX CONC	FREQ.	MAX CONC	FREQ.	MAX CONC	FREQ.	MAX CONC
ALUMINUM					13/13	7870		
ANTIMONY					2/13	5.8		
ARSENIC	22/23	45	14/14	12	5/13	1.9		
BARIUM	23/23	387	14/14	202	13/13	57.3		

BERYLIUM	6/23	1.00	1/14	0.29		
BORON						
CADMIUM	20/23	599	13/14	15	1/13	18.7
CALCIUM					13/13	3470
CHROMIUM	23/23	6419	14/14	52	12/13	153
COBALT					8/13	3.5
COPPER	23/23	722	12/14	55	12/13	33.4
CYANIDE						
IRON					13/13	7230
LEAD	22/23	972	14/14	155	13/13	122
MAGNESIUM					13/13	2000
MANGANESE					13/13	121
MERCURY	14/23	1.1	10/14	0.1		
NICKEL	20/23	203	11/14	8	2/13	6.1
PH						
POTASSIUM						
SELENIUM	4/23	0.6	5/14	0.7		
SILVER	14/23	45	7/14	6	1/13	4.3
SODIUM					13/13	57.2
SULFIDE						
SULFUR, MOL. (S8)						
THALIUM	1/23	0.76				
VANADIUM					13/13	18.7
ZINC	23/23	1091	14/14	457	12/13	124

NOTES:
NA = Not Analyzed.
Blank spaces indicate compound was analyzed for but not detected.
* Data from CH2M Hill, 1990.

The general trends in compound concentrations downgradient of the landfill lagoon are consistent with the conceptual model of flow presented previous present in the shallow fill aquifer within the landfill and sludge lagoon laterally, discharging directly into the wetlands peat and surface water, the underlying alluvial gravel and Providence Formation aquifers. Due to content of the wetlands peat deposits, it is expected that organic compoun shallow fill groundwater would be adsorbed within a short distance from th sludge lagoon. DDE and dieldrin are present in wetland soil samples (Figu relatively high concentrations in a band parallel to the downgradient edge contrast, metals compounds are present in a more widespread distribution w wetlands. This may be due to slightly acidic conditions present within th

enhances metals mobility, and because adsorption onto organic matter is no attenuating mechanism for metals as it is for organic compounds. Figures approximate areal extent of contamination above remediation levels in wetl aquatic sediment in the study area for dieldrin, mercury, and metals. Tab a summary of criteria used to select chemicals of concern for the ecologic

A total of 136 chemicals, 109 organics and 27 inorganics, were detected in compounds had the highest detected values within a sample media in upgradi total of 121 chemicals detected at downgradient locations were determined attributable to Landfill No. 4 and the sludge lagoon. Further analysis re that 25 of the chemicals detected in downgradient surface water and 32 of detected in downgradient soil/sediment were not present in landfill or slu area samples. Further, many of these chemicals were detected only once or compounds detected only in downgradient sampling locations are considered naturally occurring or are degradation products from some of the compounds Zone 1 landfill and sludge lagoon.

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TABLE 4

SUMMARY OF CRITERIA USED TO SELECT CHEMICALS OF CONCERN FOR ECOLOGICA

RISK ASSESSMENT

SURFACE WATER
RI/FS Zone 1, OU 2
Robins AFB, Georgia

Chemical	Maximum Downgradient Concentration (æg/L)	AWQCa Acute/Chronic (æg/L)	GWQCa æg/L	Bio
ORGANICS				
Bis(2-ethylhexyl)phthalate	120.0	940/3	5.92f	
Retain-Maximum concentration is				
AWQC.				
Chloroform	26.0	28,900/1,240	470.8f	
Omit-Maximum concentration is well				
bioconcentrtion is				
1,2-Dichloroethene	21.0	11,600/NAc	NA	
Omit-Maximum concentration is three				
Dieldrin	0.08	2.5/0.0019	0.0019g	
Retain-Maximum concentration is above				
bioconcentration				
Phenol	23.0	10,200/2,560	NA	
Omit-Maximum concentration is well				
Toluene	30.0	17,500/NA	301,941f	
Omit-Maximum concentration is well				
occur.				
INORGANICS				
Arsenic	14.41	360/190	50g	
concentration an order of				
AWQC, and				

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TABLE 4

SUMMARY OF CRITERIA USED TO SELECT CHEMICALS OF CONCER ECOLOGICAL RISK ASSESSMENT

SURFACE WATER
RI/FS Zone 1, OU 2
Robins AFB, Georgia

Chemical	Maximum Downgradient Concentration (æg/L)	AWQCa Acute/Chronic (ægL)	GWQCe æg/L	Bioconcentra Potentia
INORGANICS (Cont.)				
Barium	678.09	NA/NA	NA	NA
likely be present in				
Beryllium	1.20	130/5.3	0.117f	NA
concentration is below the				
Cadmium	26.87	39/11	0.7g	High
concentration is above				
Chromium (total)	72.94	16/11	120g	Low
concentration is above				
				GWQC.
Lead	318.0	34/1 3d	1.3g	Medium
concentration is well				
Mercury (total)		2.4/0.012	0.012g	High
concentration is above				

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07/24/92 ad

TABLE 4

SUMMARY OF CRITERIA USED TO SELECT CHEMICALS OF CO
ECOLOGICAL RISK ASSESSMENT

SURFACE WATER
RI/FS Zone 1, OU
Robins AFB, Geor

Chemical	Maximum Downgradient Concentration (æg/L)	AWQCa Acute/Chronic (æg/L)	GWQCc æg/L	Bioconcent Potenti	Decision
INORGANICS (Cont.)					
Nickel	23.63	1,100/564	88g	Medium	concentration is less than
Selenium	1.04	260/35	5g	NA	concentration is below the known
Silver	52.45	4.1/0.12	0.12g	NA	concentration is above
Zinc	1,242.40	65/59d	60g	High	concentration is well

a Source: USEPA 1986a. Quality Criteria for Water 1986, EPA/440/5-86-001 O and Standards. Washington, D. C.
b Persistence/Mobility: Persistence is described by a qualitative estimate remain in the environment.
Mobility is described by a qualitative estimate of from its first site of deposition. For volatile
compounds, no appreciable deposition may take place
c NA = Not Available
d Toxicity of this chemical is dependent on hardness. A mean hardness of 55 surface water samples used in bioassay tests, therefore, the
AWQC reported is adjusted for a hardness of 50 mg/L (USEPA 1986a).
e Georgia Water Qualily Criteria (GDNR 1991)

f Annual Average Flow Criterion
g Low Flow Criterion

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TABLE 5

SUMMARY OF CRITERIA USED TO SELECT CHEMICALS OF CONCER
ECOLOGICAL RISK ASSESSMENT

SOIL AND SEDIMENT
RI/FS Zone 1, OU 2
Robins AFB, Georgia

Chemical	Maximum Downgradient Concentration (mg/kg)	Potential Bioaccumulation	Persisten	species	Decision	Reference
ORGANICS						
2-Butanone	0.920	Low	Low/		Omit	USEPA 1976
Carbon disulfide	0.530	Low	Low/			
4.4'-DDD	9.0	High	High		Retain	IARC 1973
4,4'-DDE	1.300	High	High	diet;	Retain	Longcore & Samson 1973
4,4'-DDT	51.0	High	High	pheasant	Retain	Hunt et al. 1969
1,2-Dichlorobenzene	0.21	Medium	Medium		Omit	Clayton & Clayton 1981-1982
1,4-Dichlorobenzene	0.540	Medium	Medium	rabbit	Omit	Gaines 1986
1,2-Dichloroethene	0.170	Medium	Low/	inhalation;	Omit	ACGIH 1986
Dieldrin	2.90	High	High		Retain	Mendenhall et al. 1983
Benzo(a)pyrene	2.30	High	High	Retain	IARC 1973	
Phthalates	0.550	Low	High		Omit	Krauskopf 1973
Tetrachloroethene (PCE)	0.075	Low	Low/	inhalation; rat	Omit	Clayton and Clayton
Toluene	0.120	Low	Low/			
1,1,1-Trichloroethane	0.031	Low	Low/			

inhalation; Omit USA - 1981

Trichloroethene 0.220 Low Low/
rat Omit Verschueren 1983

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TABLE 5

SUMMARY OF CRITERIA USED TO SELECT CHEMICALS OF CONCER
ECOLOGICAL RISK ASSESSMENT

SOIL AND SEDIMENT
RI/FS Zone 1, OU 2
Robins AFB, Georgia

Chemical	Maximum Downgradient Concentration (mg/kg)	Potential Bioaccumulation	Persisten
species	Decision	Reference	
INORGANICS			
Arsenic	69.0	Medium	High/Low
dog	Retain	Byron et al. 1967	
Barium	281.0	NA	Hig
Mercury	1.30	High	Hig
Retain	Heinz 1974		
Nickel	0.117	NA	Hig
Omit	Ambrose et al. 1976		
Selenium	42.4	NA	Hig
Retain	Herigstad et al. 1973		
Zinc	954.0	High	Hig
Retain	Schlicker and Cox 1968		

a Persistence/Mobility: Persistence is described by a qualitative estimate
remain in the environment.
Mobility is described by a qualitative estimate of
from its first site deposition. For volatile compounds, no
appreciable deposition may take place.
b LD30 = Lethal dose for 50% of the exposed organisms at a specific t
c NA = Data Not Available
d NOEL = No observed effect level
e LOAEL = Lowest observed adverse effect level

f NOAEL = No observed adverse effect level

627\ROBINS AFB\6-4 TBL
11/11/92 kpb

5.6 CONTAMINANTS OF CONCERN

The Baseline Risk Assessment (RA) conducted for the Zone 1 RI completed in

identified the following contaminants of concern (COCs):

- Carbon Tetrachloride
- 1,2-Dichloroethene
- Tetrachloroethene
- Vinyl chloride
- Arsenic
- Cadmium
- Chromium
- Lead

The Ecological Risk Assessment (ERA) conducted for the Zone 1, OU2 RI comp

1992 identified the following contaminants of concern related to OU2 ecolo

Surface Water

- Bis(2-ethylhexyl)phthalate
- Dieldrin
- Cadmium
- Chromium
- Lead
- Mercury
- Silver
- Zinc

Soil/Aquatic Sediment

- Benzo(a)pyrene
- 4,4' DDD, DDE, DDT
- Dieldrin
- Arsenic
- Mercury
- Selenium
- Zinc

6.0 SUMMARY OF SITE RISKS

6.1 HUMAN HEALTH RISK ASSESSMENT

A human health risk assessment was completed as part of the Zone 1 RI in 1 human health risk assessment identified two potential current human exposu estimated the risk associated with each. These two exposure pathways are inhalation of contaminated dust particles and volatile organic compounds f trespassers and offsite residents and ingestion of contaminated soil, sedi water for onsite trespassers. The first pathway was residential inhalatio suggested an excess lifetime cancer risk of 3 x 10-6 for inhalation of con particles and 2 x 10-6 for inhalation of VOCs or a cumulative estimated ri The second exposure pathway is incidental ingestion of contaminated soil, surface water. The maximum estimated risk for this exposure route was 9 x incidental ingestion of sediment by child trespassers. The risk associate pathways is an acceptable risk under the NCP (10-7 to 10-4).

Human health risks associated with aquatic sediment, wetland soil, and sur ingestion were reassessed based on data collected from locations downgradi No. 4 and the sludge lagoon during the Zone 1, OU2 RI field investigation. did not increase significantly as a result of the reassessment. Carcinoge in wetland soil and for arsenic and dieldrin in aquatic sediment were high presented in the initial human health risk assessment, but still within EP (1 x 10-6 to 1 x 10-4).

Tables 6 through 11 illustrate comparisons of initial (CH2M Hill) and reas hazard index and carcinogenic risk values.

TABLE 6

COMPARISON OF CH2M HILL AND CDM ESTIMATES OF HA
FOR INGESTION OF WETLAND SOIL
RI/FS Zone 1, OU 2
Robins AFB, Georgia

Chemical	Reference Dose (RfD) (mg/kg/day)	Sourceb	Highest Detected Concentration (CH2M HILL) (æg/kg)	Down Conc ((
Antimony	0.0004	IRIS	5,800	
Barium	0.05	IRIS	57,300	
Benznoc acid	4	IRIS	210	
Bis(2-ethylhexyl)phthalate	0.02	IRIS	590	

Butyl benzyl phthalate	0.2	HEAST	200
Cadmium	0.001	IRIS	18,700
Chlordane	0.00006	IRIS	102
Chlorobenzene	0.021	SPHEM	52
Chromium Vl	0.005	IRIS	153,000
Copper	0.037	SPHEM	33,400
DDT	0.0005	IRIS	44
Dibutyl phthalate	0.1	IRIS	650
1,2-Dichlorobenzene	0.09	IRIS	970
Diethyl phthalate	0.1	IRIS	150
Ethylbenzene	0.1	lRIS	9

491\ROBINS\TABLES\5-1.TBL
07/27/92 mlh

TABLE 6 (Cont.)

COMAPRISON OF CH2M HILL AND CDM ESTIMATES OF HAZ
FOR INGESTION OF WETLAND SOIL
RI/FS Zone 1, OU 2
Robins AFB, Georgia

Chemical	Reference Dose (RfD) (mg/kg/day)	Sourceb	Highest Detected Concentration (CH2M HILL) (æg/kg)	Highe Down Conc (
Lead	0.0014	IRIS	122,000	
Manganese	0.1	IRIS	121,000	
4-Methylphenol	0.5d	IRIS	70	
Silver	0.005	IRIS	4,300	
Toluene	0.2	IRIS	250	

Vanadium	0.009	IRIS	18,700
Xylenes	2	IRIS	4
Zinc	0.2	HEAST	124,000

a Exposiure Assumptions

Exposure Setting	Trespass
Exposure Individual	Child
Soil Intake (grams/day)	0.1
Body Weight (kilograrns)	35

b Sources of RfDs:
IRIS - Integrated Risk Information System USEPA (1992a).
SPHEM - Superfund Public Health Evaluation Manual USEPA (1986b).
HEAST - Health Effects Assessment Summary Tables - USEPA (1992b).
c ND = Not Detected
d RFD currently withdrawn pending review (USEPA 1992).

491\ROBINS\TABLES\5-1.TBL
07/27/92 mlh

TABLE 7

COMPARISON OF CH2M HILL AND CDM ESTIMA
RISKS
FOR INGESTION OF WETLA
RI/FS Zone 1, O
Robin AFB, Georgia

Chemical	USEPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Sourceb	Lifetime Cancer Risk (CH2MHILL)	(CDM)
Arsenic	A	1.75	HEAST	x 10-6	
Benzo(b)fluoranthene	B2	11.5		X 10-7	
Bis(2-ethylhexyl)phthalate	B2	0.014	IRIS	8 x 10-9	
Chlordane	B2	1.3	IRIS	10-8	

DDT	B2	0.34	IRIS	10-10
1,4-Dichlorobenzene	B2	0.024	HEAST	1 x 10-9

a Exposure Assumptions

Exposure Setting	Trespass
Exposure Individual	Child
Daily Soil Intake (grams/day)	0.1
Body Weight (kilograms)	35
Number of days/week exposed	2
Number weeks/year expose	16
Number of years exposed	10
Lifetime Average Soil intake (grams/kg body wt./day)	0.000036

b Sources of Cancer Potency
IRIS - Integrated Risk Information System USEPA (1992a).
SPHEM - Superfund Public Health Evaluation Manual USEPA (1986b).
HEAST - Health Effects Assessment Summary Tables - USEPA (1992b).

c Based on benzo(a)pyrene.

491\ROBINS\TABLES\5-2.TBL
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TABLE 8

COMPARISON OF CH2M HILL AND CDM ESTIMATES OF HAZARD IN
FOR AQUATIC SEDIMENT INGESTION
RI/FS Zone 1, OU 2
Robins AFB, Georgia

Chemical	Reference Dose (RfD) (mg/kg/day)	Sourceb	Highest Detected Concentration (CH2M HILL) (æg/kg)	D Hazard Index (CDM)
Aldrin	0.00003	IRIS	6.50	
Antimony	0.0004	IRIS	19,300	
Arsenic	0.0003	IRIS	27,200	
Barium	0.05	IRIS	190,000	
Benzo(g,h,i)perylene	0.004c	HEAST	1,060	

0.0000108				
Beryllium	0.005	IRIS	1,800	
Bis(2-ethylhexyl)phthalate	0.02	IRIS	2,790	
Bromodichloromethane	0.02	IRIS	20.0	
2-Butanone	0.05	IRIS	290	
Butyl benzyl phthalate	0.2	HEAST	640	
Cadmium	0.001	IRIS	21,000	
Carbon disulfide	0.1	IRIS	4.90	
Chlordane	0.00006	IRIS	180	
Chlorobenzene	0.02	IRIS	380	
Chloroform	0.01	IRIS	64.0	
Chromium Vl	0.005	IRIS	230,000	

491\ROBINS\TABLES\5-3.TBL
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TABLE 8 (Cont.)

COMPARISON OF CH2M HILL AND CDM ESTIMATES OF HAZARD IN
FOR AQUATIC SEDIMENT INGESTION
RI/FS Zone 1, OU 2
Robins AFB, Georgia

Chemical (CDM)	Reference Dose (RfD) (mg/kg/day)	Sourceb	Highest D Concentr (CH2M HI (æg/kg	Hazard Index
Copper	0.037	SPHEM	97	0.01
DDT	0.0005	IRIS		0.0006
Dibutyl phthalate	0.1	IRIS	930	

1,1-Dichloroethene	0.009	IRIS	270	
Dieldrin	0.00005	IRIS	880	
Diethyl phthalate	0.1	IRIS	750	
Ethylbenzene	0.1	IRIS	130	0.00000009
Lead	0.0014d	SPHEM	226,00	0.8
Manganese	0.1	SPHEM	696,00	0.0000046
Mercury (alkyl and inorganic)	0.0003	IRIS	1,940	0.01
4-Methyl-2-pentanone	0.05d	IRIS	7.00	
4-Methylphenol	0.5d	IRIS	46.0	
Naphthalene	0.004	HEAST	650	0.0013
Nickel	0.02	c	20,900	
Pyrene	0.03	HEAST	5,100	0.0003
Silver	0.005	IRIS	34,000	

491\ROBINS\TABLES\5-3.TBL
07/27/92 mlh

TABLE 8 (Cont.)

COMPARISON OF CH2M HILL AND CDM ESTIMAT
FOR AQUATIC SEDIMENT INGE
RI/FS Zone 1, OU 2
Robins AFB, Georgi

Chemical	Reference Dose (RfD) (mg/kg/day)	Sourceb	Highest D Concentr (CH2M HI (æg/kg	Hazard Index HILL)	(CDM)

Tetrachloroethene	0.01	IRIS	33.0	0.00002
Toluene	0.2	IRIS	1,	0.0000015
Vanadium	0.009	IRIS	79,	0.000023
Xylenes	2	IRIS		0.00000005
Zinc	0.2	HEAST	449,	0.01

a Exposure Assumptions

Exposure Setting	Trespass
Exposure Individual	Child
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	35

b Sources of RfDs:
IRIS - Integrated Risk Information System USEPA (1992a).
SPHEM - Superfund Public Health Evaluation Manual USEPA (1986b).
HEAST - Health Effects Assessment Summary Tables - USEPA (1992b).

c Nickel value base on nickel-soluble salts.

d RfD currently withdrawn pending review (USEPA 1992a).

e Value is a proxy toxicity value based upon naphthalene.

491\ROBINS\TABLES\5-3.TBL
07/27/92 mlh

TABLE 9

COMPARISON OF CARCINOGENIC RISKS FOR AQUATIC INGESTION

CALCULATED BY CH2M HILL AND CD
RI/FS Zone 1, OU 2
Robins AFB, Georgia

Lifetime	Excess Lifetime	USEPA	Carcinogenic	
Risk	Cancer Risk			

Chemical	Carcinogen Classification	Potency Factor (kg-day/mg)	Sourceb	HILL) (CDM)
Aldrin	B2	17.0	IRIS	5.1 x 10-7
Arsenic	A	1.75	HEAST	4.3 x 10-6
Benzene	A	0.029	IRIS	5.6 x 10-11
Benzo(a)anthracene	B2	11.5	c	8.2 x 10-7
Benzo(b)fluoranthene	B2	11.5	c	8.2 x 10-7
Benzo(k)fluoranthene	B2	11.5	c	8.25 x 10-7
Benzo(a)pyrene	B2	11.5	SPHEM	10-8 9.5 x 10-7
Bis(2-ethylhexyl)phthalate	B2	0.014	IRIS	10-9 8 x 10-9
Bromodichloromethane	B2	0.130	HEAST	10-11 -
Chlordane	B2	1.30	IRIS	1 x 10-9
Chloroform	B2	0.0061	IRIS	6.5 x 10-13
Chloromethane	C	0.013d	HEAST	10-11 -
Chrysene	C	11.5	c	8.7 x 10-7
DDD	B2	0.240	IRIS	4.6 x 10-9
DDE	B2	0.340	IRIS	x 10-8
DDT	B2	0.340	IRIS	1.3 x 10-9
Dibenz(a,h)anthracene	B2	11.5	c	

1,4-Dichlorobenzene	B2	0.024	HEAST	10-10 4.6 x 10-10

472\ROBINS\TABLES\5-4.TBL
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TABLE 9 (Cont.)

COMPARISON OF CARCINOGENIC RISKS FOR AQUATIC INGESTION

CALCULATED BY CH2M HILL AND
RI/FS Zone 1, OU 2
Robins AFB, Georgia

Chemical	USEPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Sourceb	Lifetime Risk HILL)	Excess Lifetime Cancer Risk (CDM)
1,1-Dichloroethane	C	0.0914	HEAST	-	
Dieldrin	B2	16.0	IRIS	1.6 x 10-6	
Indeno(1,2,3 cd)pyrene	B2	11.5	-	4.5 x 10-7	
Tetrachloroethene	B2	0.051d	SPHEM	10-11	1.4 x 10-11
Trichloroethene	B2	0.011d	IRIS	8.7 x 10-11	

a Exposure Assumptions

Exposure Individual	Child
Exposure Setting	Trespass
Daily Soil Intake (grams/day)	0.1
Body Weight (kilograms)	35
Number of days/week exposed	2
Number weeks/year exposed	16
Number of years exposed	10
Lifetime Average Soil Intake (grams/kg body wt./day	0.000036

b Sources of Cancer Potency Factors:

IRIS - Integrated Risk Information System USEPA (1992a).
SPHEM - Superfund Public Health Evaluation Manual USEPA (1986d).
HEAST - Health Effects Assessment Summary Tables - USEPA (1992b).

c Based on benzo(a)pyrene.

d RfD currently withdrawn pending review (USEPA 1992).

472\ROBINS\TABLES\5-4.TBL
07/27/92 mlh

TABLE 10

COMPARISON OF CH2M HILL AND CDM ESTIMA
FOR INGESTION OF SURFACE
RI/FS Zone 1, OU
Robins AFB, Georg

Chemical (CDM)	Reference Dose (RfD) (mg/kg/day)	Sourceb	Maximum Concentration (CH2M HILL) (æg/kg)
Antimony	0.0004	IRIS	72.8
Arsenic	0.0003	IRIS	12
Barium	0.05	IRIS	1,360
Beryllium	0.005	IRIS	3.8
Bromodichloromethane	0.02	IRIS	3
2-Butanone	0.05	IRIS	11
Cadmium	0.001	IRIS	128
Chlorobenzene	0.02	SPHEM	5
Chloroform	0.01	IRIS	11
Chromium Vl	0.005	IRIS	1,390
Copper	0.037	SPHEM	856
Cyanide	0.02	c	67.1
Lead	0.0014c	SPHEM	1,400

Manganese	0.1	IRIS	2,700
Mercury (alkyl and inorganic)	0.0003	IRIS	14

491\ROBINS\TABLES\5-5.TBL
07/27/92 mlh

TABLE 10 (Cont.)

COMPARISON OF CH2M HILL AND CDM ESTIM
INDICES

FOR INGESTION OF SURFAC
RI/FS Zone 1, O
Robins AFB, Geo

Chemical	Reference Dose (RfD) (mg/kg/day)	Sourceb	Maximium Concentration (CH2M HILL) (æg/kg)	Maximum Index
4-Methyl-2-pentanone	0.05	IRIS	4	
Nickel	0.02	d	97.6	
Pyrene	0.03	HEAST	12	
Selenium	0.005	IRIS	5.7	
Silver	0.005	IRIS	239	
Toluene	0.3	IRIS	5	
Vanadium	0.009	IRIS	203	
Zinc	0.2	HEAST	5,070	

a Exposure Assumptions

Exposure Setting	Trespass
Exposure Individual	Child
Water Intake (liters/day)	0.05
Body Weight (kilograms)	35

b Sources of RfDs:
IRIS - Integrasted Risk Information System USEPA (1992a).
SPHEM - Superfund Public Health Evaluation Manual USEPA (1986b).
HEAST - Health Effects Assessment Summary Tables - USEPA (1992b).

c Cyanide value based on free cyanide.
d Nickel value based on nickel-soluble salts.
e RfD currently withdrawn pending review, (USEPA 1992a).

491\ROBINS\TABLES\5-5.TBL
07/27/92 mlb

TABLE 11

COMPARISON OF CH2M HILL AND CDM ESTIM
RISKS

FOR INGESTION OF SURF
RI/FS Zone 1, OU
Robins AFB, Georg

Chemical	USEPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Sourceb	Max Maximum Concentrati (CH2M HILL (ægL)	Cancer Risk (CDM)
Arsenic	A	1.75	HEAST	12	
Benzene	A	0.029	IRIS	5	
Bromodichloromethane	B2	0.13	HEAST	3	10-8
Chloroform	B2	0.0061	IRIS	11	
Trichloroethene	B2	0.011c	IRIS	7	

a Exposure Assumptions

Esposure Setting	Trespass
Daily Water Intake (liters/day)	0.05
Body Weight (kilograms)	35
Number of days/week exposed	2
Number weeks/year exposed	16
Number of years exposed	10
Lifetime Average Water Intake	0.00002 (liters/kg body wt./day)

b Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System USEPA (1992a).
SPHEM - Superfund Public Health Evaluation Manual USEPA (1986b).
HEAST - Health Effects Assessment Summary Tables - USEPA (1992b).

c Carcinogenic Potency Factor currently withdrawn pending review (USEPA 19

491\ROBINS\TABLES\5-6.TBL
07/27/92 mlh

6.2 ECOLOGICAL RISK ASSESSMENT

This Ecological Risk Assessment (ERA) used several different approaches fo potential risk to ecological receptors from contaminants attributable to L adjacent sludge lagoon. Media-specific concentrations of chemicals were m samples collected at appropriate reference, upgradient, and downgradient l addition, ecological and toxicological approaches were used to assess site in potential impacts from chemical contamination. These ecological and to approaches included macroinvertebrate sampling, a USEPA Rapid Bioassay Pro III evaluation, surface water and sediment toxicity tests, fish and macrop a Wetland Evaluation Technique (WET) assessment, and a breeding bird surve

6.2.1 AQUATIC ECOSYSTEM

Table 12 summarizes estimated surface water and sediment exposure point co aquatic receptors along with Ambient Water Quality Criteria (AWQC), sedime values, and no observed adverse effect level (NOAEL) or lowest observed ad level (LOAEL) dietary concentrations for higher trophic level species that For chemicals not considered to be aquatic sediment COCs, mean and maximum sediment values are presented.

A review of Table 12 indicates that the greatest potential risk for aquati direct contact with metals via sediment and surface water. In particular, mercury, silver, and zinc exceed both surface water criteria and sediment

addition, mercury and zinc are ubiquitous, occurring in nearly every aquat sample, while cadmium, lead, and silver occur primarily in pond sediments. water, higher concentrations, including all exceedences of AWQC, consisten wetland area approximately 800 ft. northeast of the landfill and southwest study area. No exceedances of AWQC were detected in any permanent water b study area. For aquatic sediment and wetland soil, the distribution of me pattern similar to surface water. Higher concentrations, including most e

Table 12

AQUATIC ECOSYSTEM RISK CHARACT
RI/FS ZONE 1,
Robins AFB, Ge

Chemical	Surface Waterb (mg/L)	AWQCb Acute/Chronic (mg/L)	Potentially Aquatic Sedimen (mg/kg)	Reference Contaminated Concentration (mg/kg)	Dietary
ORGANICS					
Benzo(a)pyrene	NCf	NA8/NA	1.16		
Bis(2-ethylhexyl) phthalate	0.089	0.940/0.003c	16(6.2	25 (LOEL, starling)	
4,4'DDD	NC	NA/NA	0.048	(LOAEL, black duck)	
4,4'DDE	NC	1.05/NA	0.049	(LOAEL, black duck)	
Dieldrin	0.00008	0.0025/0.0000019	ND	0.16/0.5 (NOAEL, rat/	
INORGANICS					
Cadmium	0.023	0.039/0.011	20(14)		

(NOAEL, sheep)			
Chromium	0.067	1.70/0.210(III) 0.016/0.011(IV)	220(50
Lead	0.18	82/0.0032	360(85
(LOAEL, American			
Mercury	0.0005	0.0024/0.000012	1.19
0.55 (NOAEL, mallard			
Silver	0.044	0.0041/0.00012	61(3
Zinc	0.54	0.047/NA	856
(NOAEL, rat)			

a Estimated media concentrations are taken from Table 6-6 (surface water) of OU2 RI.
b Ambient Water Quality Criteria for protection of aquatic life. Source: Water, Office of Regulations and Standards, EPA/440/5-86-001.
c Source: Washington State Administrative Code 1991. Department of Ecolo Sediment Management Standards; Adopted March 27, 1991, effective April 27, 199
d Estimated aquatic plant and prey concentrations are based on data collec P2, P3, S7, S8, and S13. See Sect. 6.3.3 of OU2 RI for discussion regarding selected values.
e Values taken from Table R1.
f NC=Not Calculated for indicated media.
g NA=Not Available.
h ND-Not Detected.
i Not a sediment COC. For reference, maximum downgradient value provided parentheses.
j Source: National Oceanic and Atmospheric Administration 1990. The Pote Sediment-Sorbed Contaminants Tested in the National Status and Trends Program, NOAA Technical Memorandum NOS OMA 52.

sediment toxicity values, consistently occur in the wetland area northeast

southwest of the ponds. In addition, the ponds appear to be accumulating

The organics appear to present a minimal risk in surface water and sedimen

Benzo(a)pyrene is not a COC for surface water and the estimated aquatic se

point concentration is close to the sediment toxicity value. The estimate

concentration for bis(2-ethylhexyl)phthalate exceeds the chronic AWQC by a

magnitude, but the maximum sediment concentration is half the toxicity val

water and sediment concentrations for the pesticides are quite low and are present a significant risk via direct ingestion or contact.

A comparison of the contaminated prey (fish) data and the NOAEL and LOAEL concentrations for sensitive piscivorous predators indicates that, with th mercury, none of the COCs appear to be accumulating enough to cause a dire However, mercury bioaccumulates rapidly in aquatic environments.

6.2.2 TERRESTRIAL ECOSYSTEM

Table 13 presents estimated exposure point concentrations for wetland soil contaminated vegetation and prey along with LOAEL or NOAEL dietary concent species at high trophic levels. A review of the estimated exposure point wetland soil indicates that direct ingestion of wetland soil may pose a ri concentration of DDT and dieldrin. Although wetland soil would not be ing rate as food, soil ingestion may be significant for burrowing animals or a wild boar, which spends a considerable amount of time digging in the soil. dieldrin appear to be ubiquitous in wetland soil, occurring in most wetlan

Consumption of contaminated prey may pose a risk due to potential levels o mercury in prey species. However, the risks associated with cadmium are e much less significant than those associated with mercury. Mercury has a h bioaccumulate and to biomagnify, and the biomagnification of mercury can r upper trophic level predators.

TABLE 13
TERRESTRIAL ECOSYSTEM RISK CHARACTERIZATION
RI/FS ZONE 1, OU2
Robins AFB, Georgia

Chemical	Wetland Soila (mg/kg)	Potentially Contamina Vegetationb (mg/kg)
ORGANICS		
Benzo(a)pyrene	0.90	ND
Bis(2-ethylhexyl)phthalatec	NDf	9.5
4,4'DDD	0.87	ND
4,4'DDE	0.28	ND
4,4'DDT	7.36	ND
Dieldrin	0.53	ND
INORGANICS		
Arsenic	24.77	ND
Cadmiumd	NDc	1.5
Mercury	0.34	0.04
Selenium	9.69	ND
Zinc	84.79	27.7

ND = Not Detected
NC = Not Calculated
a These values are potential exposure point concentrations shown on Table
b Represents the maximum concentration detected in vegetation from co-loc
6-10 or OU2 RI).
c Calculation of these values is discussed in Section 6.3.4 of OU2 RI.
d Values taken from Table 6-10 of OU2 RI.
e Although this chemical was not selected as a soil and sediment COC, it
detected in terrestrial vegetation.
f Chemical was not detected in the soil samples that were co-located with

6.2.3 ERA CONCLUSIONS

The ERA concluded that for ecological receptors, the risks are low or cont
small areas (i.e., the ponds and drainage ditches), and indicated that sev
may be affecting the wetlands downgradient of Zone 1. These factors inclu

sources of contamination and various AFB management activities that influe
regime in the wetlands. The ERA also concluded that the wetlands associat
provide an important habitat for a variety of wetlands plants and animal s
the ecological risks are low or are confined to relatively small areas, pr
wetlands should be given a high priority when evaluating remedial alternat

The selected interim remedy (Alternative 2, Limited Action) includes the f

Institutional controls (i.e., fence construction to restrict access
future site access and water-use restrictions.

Comprehensive monitoring for a minimum of one year not to exceed th
support of physical/chemical and ecological/biological monitoring p
developed to monitor stabilization of the site following redirectio
around the landfill and diversion of industrial wastewater discharg
of the landfill and wetlands, so that a final remedial action can b
current and expected future conditions.

Development of a contingency plan that describes containment measur
implemented in the event that predetermined "trigger values" are ex

7.0 DESCRIPTIONS OF ALTERNATIVES

The following is a summary of the alternatives evaluated for the wetlands
Zone 1, OU2. Specific details were developed to allow order-of-magnitude

7.1 ALTERNATIVE 1 - NO ACTION

No monitoring, institutional controls, remedial or treatment actions will

7.2 ALTERNATIVE 2 - LIMITED ACTION

The Limited Action alternative consists of institutional controls (i.e., f
restrict access, posting signs) for future site access and water use restr
a defined time frame in support of physical/chemical and ecological/biolog
plans to be developed and implemented as the remedial design for the Actio
development of a contingency plan that describes containment measures to b
the event that predetermined "trigger values" set in the monitoring plans
monitoring plans will define analysis (contaminants of concern, physical p

media to be sampled (soil, sediment, water, fish, vegetation, etc.), sampl schedule, and hydrological input and output points in the wetlands to be m elevation and chemistry.

7.3 ALTERNATIVE 3 - SURFACE WATER COLLECTION, TREATMENT, AND RECIRCULATION

Alternative 3 includes collection of surface water, treatment of the water inorganic contaminants of concern, recirculation of the treated water back and monitoring as described under the limited action alternative.

7.4 ALTERNATIVE 4 - DREDGING/DEWATERING AND SOLIDIFICATION OF AQUATIC SEDIMENTS, WITH ONSITE DISPOSAL

Alternative 4 would require dredging/dewatering and solidification of appr cubic yards of aquatic sediment, onsite disposal, and monitoring as descri limited action alternative. Dewatered solids would be stockpiled and trea solidification/fixation. Final disposal would be in a Resource Conservati Act (RCRA) cell constructed on base in a designated area for this purpose.

7.5 ALTERNATIVE 5 - DREDGING/DEWATERING AND OFFSITE DISPOSAL OF AQUATIC SEDIMENTS.

Alternative 5 would require dredging/dewatering of approximately 171,295 c aquatic sediments and loading and transporting it to an offsite RCRA-permi landfill.

A remedial design for any of the monitoring or treatment alternatives may field investigation to further delineate the area to be addressed by remed and characterize source areas not included under OUI.

8.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The wetlands associated with OU2 are currently providing important habitat species. Results for the ecological risk assessment show that viable and of aquatic and terrestrial wildlife are currently using the habitats in Zo

It should be noted that designing and implementing an action while the wet (due to redirection of runoff and diversion of industrial waste discharge) or efficient. Any design or implementation can be better performed when t a steady state hydrology or water balance.

8.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 1 would not rapidly eliminate exposure pathways. However, ove attenuation may reduce the concentrations of contaminants to below remedia especially once the sources of contamination are controlled. Alternative Alternative 1 except that institutional controls associated with Alternati minimize potential direct exposure to hazardous substances. In addition, program associated with Alternative 2 would monitor stabilization of the s redirection of runoff discharge and diversion of industrial wastewater dis upgradient of the landfill and wetlands so that a final Remedial Action ca the current and expected future conditions. Alternative 3 would remove CO drainage ditch, ponds, and surface water at the collection points, but oth discharges to Horse Creek would not be controlled. Alternative 4 would re contaminated sediment affecting aquatic organisms, but would also eliminat benthic organisms and the habitat which are not easily replaced. In addit resuspend contaminated sediments which may cause contaminants to enter the

chain. Alternative 5 provides an overall protectiveness similar to that p

Alternative 4, but would also eliminate risks associated with the fixation of metals from fixed solids (Alternative 4). Finally, an effective implem Alternatives 3, 4 or 5 may not be possible until after the wetlands reach hydrology or water balance.

8.2 COMPLIANCE WITH ARARs

Chemical-, location-, and action-specific ARARs which potentially apply to presented in the OU2 FS. The Wetlands Management Executive Order, Executi 11990, Protection of Wetlands (40 CFR 6.302) is also applicable. However, CERCLA 121(d)(4) and NCP 300.430(f)(1)(ii)(C)(1), compliance with ARARs is because the selected action is an interim remedy; that is, the selected re part of a total remedial action that will attain ARARs.

8.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Because the interim action is not designed or expected to be final, and is remedial action can be developed from the current and expected future cond comparison of alternatives in terms of long-term effectiveness and permane relevant.

8.4 REDUCTION OF MOBILITY TOXICITY OR VOLUME (M/T/V) THROUGH TREATMENT

Alternative 1 and 2 would not decrease M/T/V, however, toxicity and volume reduced through natural attenuation if contaminant concentrations decrease

Alternative 3 would provide a net decrease in offsite migration of contami
Alternative 4 eliminates mobility and toxicity of contaminants through tre
since solidification/stabilization is required, volume may increase. Alte
mobility and toxicity of contaminants through offsite disposal.

8.5 SHORT-TERM EFFECTIVENESS

Alternatives 1 and 2 pose minimal short-term risks to onsite workers. Alt
construction activities may disturb sediments and results in the release o
contaminants to Horse Creek.

The limiting factor in processing time for dredging activities and operati
Alternative 4 and 5 will be dewatering. Alternatives 3, 4, and 5 would re
approximately two years for implementation. Technical considerations for
include control of sediment spreading during dredging, treatability testin
design of a RCRA cell. Technical considerations for Alternative 5 include
sediment spreading during dredging, obtaining permits and manifests for of
facility accepting waste.

8.6 IMPLEMENTABILITY

Alternatives 1 and 2 could be implemented immediately. Development and im
of a comprehensive monitoring plan and the use of institutional controls,
for Alternative 2. Alternative 2 will allow for monitoring the stabilizat
following redirection of runoff discharge and diversion of industrial wast
that a final remedial action can be developed from the current and expecte
Alternative 3 could be implemented in approximately two years and would in
system design, pilot-scale studies, disposal of biological sludge and used

Alternatives 4 and 5, the limiting factor in processing time would be dewa
Alternatives 3, 4, and 5 would require approximately two years for impleme
Technical considerations for Alternative 4 include control of sediment spr
dredging, treatability testing and location and design of a RCRA cell. Te
considerations for Alternative 5 include control of sediment spreading dur
obtaining permits and manifests for offsite disposal and facility acceptin
interim remedy, Alternatives 3, 4 or 5 are less feasible than Alternative
required to implement them and because implementation may not be effective
while the water balance in the wetlands is changing.

8.7 COST

The cost for Alternative 2 is estimated to be significantly less than Alte
(See Table 14). It should be noted that estimated costs for Alternatives
remediation of an areas exceeding National Oceanic and Atmospheric Adminis
(NOAA) screening values. Costs could potentially be reduced pending furth
the area to be addressed by remediation during the remedial design.

8.8 AGENCY ACCEPTANCE

The U.S. EPA and GEPD have accepted Alternative 2 as an interim remedy (co
upon public acceptance).

8.9 COMMUNITY ACCEPTANCE

Based on comments made by citizens at the public meeting held on September
believed that the community is supportive of the selected interim remedy f

(institutional controls and monitoring). One citizen did recommend that A (surface water collection, treatment, and recirculation) be selected for O even through sediment contamination would not be changed significantly, tr and returning it will not do more damage to the wetlands.

Table 14: Wetlands Alternatives
Robins AFB, Georgia

		Estimated Capital Cost	Estimated Annual O&M Cost	Estimate Present Cost
1.	No Action	$ 0	$ 0	$
2.	Limited Action: Institutional Controls and Monitoring	225,000	67,550	889
3.	Surface water collection treatment, and recirculation	1,818,375	672,933	7,35
4.	Dredging/dewatering and solidification of aquatic sediments with onsite disposal	23,382,316	184,081	24,86
5.	Dredging/dewatering and offsite disposal of aquatic sediments	54,223,219	43,900	54,41

9.0 SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analy alternatives, and public comments, Robins AFB in consultation with U.S. EP has determined that the most appropriate interim remedy for the wetlands a OU2 is Alternative 2.

The interim remedy for OU2 Impact on Wetlands includes:

Institutional controls (i.e., fence construction to restrict access future site access and water use restrictions.

Comprehensive monitoring for a minimum of one year not to exceed th support of physical/chemical and ecological/biological monitoring p developed to monitor stabilization of the site following redirectio around the landfill and diversion of industrial wastewater discharg of the landfill and wetlands so that a final remedial action can be current and expected future conditions.

Development of a contingency plan that describes containment measur implemented in the event that predetermined "trigger values" set in plan are exceeded.

A remedial design for the monitoring alternative may require additional fi

further delineate the area to be addressed by remediation, and/or define a

source areas not included under OUT.

The estimated cost of the selected interim remedy is presented in Table 15

Table 15: Selected Interim Remedy Cost Estimate

Estimated Capital Cost:	$225,000
Estimated Annual O&M Cost:	$ 67,550
Estimated Total Present Worth Cost:	$889,011

9.1 REMEDIATION GOALS

The specific objectives of the selected interim remedy are to:

1. Protect existing habitat.

2. Minimize the potential direct and indirect exposure of the public to hazardous substances.

3. Monitor the stabilization of the site following redirection of run around the landfill and diversion of industrial wastewater dischar upgradient of the landfill and wetlands, so that a final remedial developed from the current and expected future conditions.

10.0 STATUTORY DETERMINATIONS

Under its legal authorities, the EPA's primary responsibility at Superfund undertake remedial actions that achieve adequate protection of human healt environment. In addition, Section 121 of CERCLA establishes several other requirements and preferences. These specify that when complete, the selec action for this site must comply with applicable or relevant and appropria standards established under Federal and State environmental laws unless a justified. The selected remedy also must be cost-effective and utilize pe and alternative treatment technologies or resource recovery technologies t extent practicable. Finally, the statute includes a preference for remedi treatments that permanently and significantly reduce the volume, toxicity, hazardous wastes as their principal element. The following sections discu remedy meets these statutory requirements.

As the lead Agency, the Air Force is required to comply with CERCLA 120, (Order 12580 of January 23, 1987), and EPA is to determine that they are co CERCLA 120.

10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected interim remedy protects human health and the environment thro of institutional controls (i.e., fence construction, posting signs) for fu water use restrictions and 2) the development and implementation of a comp monitoring program to monitor stabilization of the site following redirect discharge and diversion of industrial wastewater discharge, so that a fina be developed from the current and expected future conditions. Further pro health and the environment is provided through the development of a contin

describes containment measures to be implemented in the event that predete values" set in the monitoring plan are exceeded.

This interim action does not employ a remedy that permanently and signific toxicity, mobility, or volume of the contaminants because the interim acti or expected to be final. More specifically, designing and implementing a while the wetlands are changing may not be effective or efficient. Any pe implementation can be better performed when the wetlands reach a steady st water balance.

10.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs for this limited scope action (described in the OU2 FS), and includi Management Executive Order, Executive Order 11990, Protection of Wetlands (40 CFR 6.302) have been waived pursuant to CERCLA 121(d)4 and NCP 300.430(f)(1)(ii)(C)(1), because the selected interim action is only part action that will attain ARARs.

10.3 COST EFFECTIVENESS

The selected interim remedy for the wetlands associated with OU2 has been provide overall effectiveness proportional to its cost, and provides a rea money. The total present worth cost is $889,011. The cost/effectiveness Alternatives 3, 4 and 5 do not compare to Alternative 2, because as indica designing and implementing an action while the wetlands are changing may n or efficient.

10.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES (OR RESOURCE RECOVERY TECHNOLOGIES) TO THE MAXIMUM EXTENT PRACTICABLE

The selected action is interim and is not designed or expected to be final

interim remedy represents the best balance of tradeoffs among alternatives

pertinent criteria, given the limited scope of action.

10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The statutory preference for remedies that employ treatment as a principal

addressed in the final decision document for OU2.

10.6 DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes from the proposed plan were made.

COMMUNITY RELATIONS

RESPONSIVENESS SUMMARY

COMMUNITY RELATIONS RESPONSIVENESS SUMMARY

1.0 OVERVIEW

Robins AFB along with the U.S. EPA and GEPD held a public meeting on Septe

1993 at the Warner Robins City Hall to discuss the results of the RI/FS fo

proposed interim plan for OU2, and solicit comments and questions from the

the comments received during the public comment period (August 10, 1993 to 1993) were received during the public meeting, however, several were not d OU2.

2.0 BACKGROUND ON COMMUNITY INVOLVEMENT

An active community relations program providing information and soliciting conducted by Robins AFB for Zone 1. Interviews of citizens on base and in were conducted in the summer of 1990 to identify community concerns. No s concerns that required focused response were identified. Regular informat updates have been provided to the public through television programs, the newspaper, The Rev-Up, the Warner Robins Daily Sun, and the Macon Telegrap Report, a weekly 15-minute television program produced by the Office of Pu provided routine progress updates. This program is aired Sunday mornings in Macon, Georgia. It also is telecast on Cox Cable and Watson Communicat which are available to Robins AFB and Warner Robins residents. Weekly inf articles have appeared in The Rev-Up newspaper. In addition, NPL site and have been prepared and made available in the Environmental Information Rep in the Nola Brantley Memorial Library in Warner Robins.

3.0 SUMMARY OF PUBLIC COMMENT AND AGENCY RESPONSE

Comments and questions raised during the public meeting held on September summarized below. No other comments or questions were received during the comment period.

1. A concerned citizen asked why a cost associated with an alternative (A

Limited Action) was listed as 0 dollars on one slide and 520,000 dolla slide. She did not understand the difference between the two.

Robins AFB Response: When the proposed plan was originally submitted, the dollar cost was omitted. The second slide was included to clarify that th associated with the alternative. It should be noted that cost figures are present an exact cost estimate of each alternative, but rather to serve as between one alternative to another. Because the omission was made in each alternatives, a consistent comparison was made.

2. A concerned citizen asked if Alternative 2 (Limited Action) has been s Operable Unit (OU2).

Robins AFB Response: The proposed plan (Alternative 2) is the bench progr reason Alternative 2 was selected was to allow further characterization of significant changes in water flow had occurred. Rather than making measur knowing what the water balance is going to be, Alternative 2 allows us to potentially significant changes to the water balance.

3. The same concerned citizen asked for an update on the status of Operab she understood that the alternative selected for the stabilization of working and wanted to know what would happen if the solidification pro work.

Robins AFB Response: Solidification is the alternative for stabilization. evaluation for solidification of the sludges was solely a demonstration. demonstration was to demonstrate a particular technology. It was not mean remedy. That particular technology did not work, but it is not the only a Since then, we have contracted five contractors to evaluate their technolo the list to three contractors. We have evaluated their proposals, studied scale studies for the past year and will soon announce which of the contra the work. All of the studies from the three remaining contractors indicat technologies worked in their bench- and pilot- scale studies.

4. The same concerned citizen commented that her group's research indicat all of the solidification processes were experimental to an extent in represent long-term solutions, and requested that another alternative The commentor also requested that alterative number 3 (surface water c treatment, and recirculation) be chosen for OU2, because public hearin indicate there are significant amounts of pollution coming from all so areas, and it would not cause any damage to start treating the water n the swamp. Finally, the commentor expressed concern that the interim address bioaccumulation. She indicated that DDT is one of the contami out of the waste dump and stated that a link exists between bald eagle as breast cancer in women and DDT, and that arsenic and lead never dis

of biological contamination. She expressed concern over people eating pollutants bioaccumulate in the Ocmulgee River and that pollution from as the pipeline is putting an even greater strain on the river and its

Robins AFB Response: Your concern is appreciated. All appropriate altern studied.

EPA Response: The wetland area is a very diverse bio-environment. The pl landfill into the wetlands are fairly well-defined, and because they are f the migration rate known, we would be looking at some other kind of action were occurring. However, approximately 70% of the inflow is not going int anymore, so the environment is changing. The concern with conducting a re this point, is that more damage than good will be done because we don't kn terms of the changing water level and its effect on the wetlands.

5. A concerned citizen commented on the previous commentor's statements. that the speaker made some rather sweeping assertions that she should document because the press was present and they would pick up on her a being true and certain, which would be a disservice to the effort bein commentor stated that the previous commentor's assertions should be re belief as to what is happening and not as a matter of fact. The previ responded that she did not believe she had made any assertions and wou her convictions.

Robins AFB Response: No response was made.

6. A concerned citizen asked for a review of the status of OU1 including frame for completion. The commentor stated his understanding of the s was that the Air Force would be proceeding with the remediation of the correcting the problem from the landfill. The concern then is what th process does to water flow in the wetlands, so the plan is to select a provides for intensive monitoring. The commentor also stated his unde process has been in progress for about ten years and an agreement betw Georgia Department of Resources and the Air Force has been made to try the process.

Robins AFB Response: The alternative selected for OU2 is an Interim Plan. final action. The final actton will be determined after additional monito obtained and evaluated. The ultimate completion of the cycle (OUT source projected for 1998. Solidification studies will be completed and evaluate proceedings will then be initiated. A construction contract could be let quarter of 1997. The lagoon will be solidified first and the material pla A new cap will then be placed on the landfill. The cost will probably be 100 million dollars for the whole cycle (source control)

7. The same concerned citizen asked if the Air Force was in a position to the remedial action if something was not working.

Robins AFB Response: The Air Force in conjunction with the regulatory aut required to review the remediation effort every five years and make sure t actions taken are effective. This process is required by the regulatory a

8. A concerned citizen expressed concern about trichloroethylene and meth levels in the lagoon, a chemical to treat fire ants in the swamp area,

materials buried in the swamps and wetlands and their effect on the aq of lead levels where a pipeline was constructed on a Mr. Robinson's pr that he would like to bring three individuals who could point out area hazards he discussed exist.

Robins AFB Response: The comment period is open through September 29. Wr comments may be submitted to the address provided on the handout received For more information, contact the public affairs office at Robins AFB.